

## **"NSTAR Xenon Ion Thruster on DS1: Ground and Flight Tests"**

**M. Marcucci<sup>1)</sup> , J. Polk<sup>2)</sup>**

1) Senior Staff, Thermal and Propulsion Engineering Section, Jet Propulsion Lab,  
Pasadena, CA, 91109. E-mail: michael.g.marcucci@jpl.nasa.gov

2) Group Supervisor, Thermal and Propulsion Engineering Section, Jet Propulsion Lab,  
Pasadena, CA, 91109. E-mail: james.e.polk@jpl.nasa.gov

After having been in development for many years at Glenn Research Center (formerly the Lewis Research Center), the NASA designed 30 cm ring-cusp xenon ion engine was launched on the DS1 spacecraft on 24 Oct 98 from the Kennedy Space Center in Florida. It has since accumulated 1800 hours of in-space thrusting at many different input power levels and has successfully placed the spacecraft on a trajectory to fly by the asteroid 1992KD in July 99.

The design, assembly, test, integration, and operation of this thruster comprises a unique path of technical determination, artful design choices, persistent engineering and analysis, and mastery of vacuum chamber operations. The testing program over the development years, the assembly and integration periods, and the flight operational period thus far has shown that the project test philosophy of segregating effects against unique causes proved itself most useful. The 8000 hour life test, the culmination of that ground test plan, not only met its goals but surpassed them with margin.

This talk will explain the thruster test program from beginning to end, illustrating the technical and programmatic decision making along the way. It will justify the use of engineering models as an inexpensive method of determining answers to key design questions and will explain why testing of the thruster alone only solved a portion of the system operations task. The highlight of the test program proved to be the vacuum firing of the ion engine during the spacecraft's solar thermal vacuum test.

We will conclude by comparing the pre-flight data with post-flight data to show that our high confidence was warranted for executing a successful flight to the asteroid and beyond.